SOME OBSERVATIONS ON THE BEHAVIOUR OF ISOLATED AND INTERPOSED JEJUNAL AND ILEAL SEGMENTS IN THE RABBIT

Submitted by

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Since F.P. Mall (1896) first studied the behaviour of reversed segments of the intestine there has been considerable interest in the mechanism of peristalsis and the effects of interposed segments in the gastro-intestinal tract. This work has recently found application in two main fields, viz, in the control of intestinal hurry and in replacement of damaged or non-functioning sphincters. F.A. Henley (1953) described the use of interposed jejunal segments in the treatment of post-vagotomy diarrhoea or post-gastrectomy "dumping" syndrome. Others, (Rutledge 1964, Hedenstedt 1968 and Poth 1969), have refined his original technique, and Hedenstedt (1968) recommends the use of anti-peristaltic segments of proximal ileum in the treatment of post-vagotomy diarrhoea, and iso-peristaltic segments in the treatment of the post-gastrectomy dumping syndrome.

It has been demonstrated tha nutritional balance can be maintained after colectomy or massive resection of ileum by interposition of a reversed ileal segment in continuity with the gut remnant (Singleton et al., 1961 and Budding and Smith 1967). Stalgren (1962) stressed that the boundary between obstruction and physiologically retarded intestinal transit time was fine, and demonstrated that reversal of segments of small intestine greater than 5 cm in length always caused some degree of obstruction/

obstruction. It has been demonstrated that active reversed peristalsis occurs in these segments, causing partial obstruction which delays transit time and therefore promotes absorption of gut contents, (Singleton et al., 1961).

In 1960, Torbey made the observation, confirmed by Herrington (1966), that some short segments of ileum supplied by only one vascular pedicle exhibited a high degree of tone, and remained contracted after isolation from the rest of the gut. He further showed that such segments could be substituted for the urethral sphincter in both male and female dogs, conferring urinary continence and a micturating pattern similar to normal in otherwise incontinent animals. Torbey (1961) also replaced the anal sphincters by single vessel ileal segments in dogs and showed that in 8 out of 10 dogs faecal continence was achieved.

The purpose of this study is to compare, in the rabbit, some aspects of the motor behaviour of interposed segments of proximal jejunum and distal ileum of varying lengths, and to examine the relationship between vascular supply and tone in the segments.

EXPERIMENTAL DESIGN

Experiments were conducted on 68 male and female rabbits in order to determine the relationship between the length of interposed segments of proximal jejunum and distal ileum and the resultant degree of obstruction proximal to these segments.

1 (a)/

1. (a) Anti-peristaltic segments of distal ileum of varying lengths were interposed between ileum and anterior abdominal wall, and pressures in the ileum proximal to the anastomosis studied.

   (b) Iso- and anti-peristaltic segments of distal ileum of varying lengths were interposed in terminal ileum, and pressures proximal to the segments studied. Recordings were made via a Mann-Bollman fistula placed distal to the interposed segment.

2. Iso- and anti-peristaltic segments of proximal jejunum of varying lengths were interposed in jejunum and pressures proximal to the segments were recorded via a distally placed Mann-Bollman fistula.

In both groups of experiments gut segments were selected so that those supplied by more than one vascular pedicle were all longer than 5.5 cm and those supplied by only one vascular pedicle measured between 3.5 and 5.5 cm before isolation.

MATERIALS AND METHODS

In each experiment anaesthesia was induced with intra-venous nembutal 24 mg/kg body weight, and maintained with nitrous oxide 1.5 L/min, halothane 0.5%, and oxygen 0.75 L/min using open circuit. Operations were clean but not sterile.

Experiment 1/

Experiment 1

(a) In 24 rabbits the abdomen was opended through a longitudinal mid-line incision, and segments of ileum of varying lengths centred on a point 20 cm proximal to the ileocaecal valve were isolated. The terminal 20 cm of the ileum was not used because of the proximity of the caecum and the appendix which share their blood supply with this part of the ileum. The isolated segments were interposed iso- or anti-peristaltically between distal ileum and the anterior abdominal wall, and the distal ileal stump was closed with a purse string suture, (Fig. 1). All anastomoses were made with single layer 5/0 interrupted silk sutures and no attempt was made to evert or invert the suture line. Finally, to facilitate radiological identification, the suture line was marked with a metal clip, and all defects in the mesentery were then closed. In the last 14 rabbits in this group, part of the omentum was excised and looped lightly around the anastomotic site. A fine soft open tipped catheter (Portex transparent vinyl tubing 1.0 mm internal diameter) was introduced and sewn in place with the external end closed. The internal end of the catheter, which was marked with a radio-opaque dot, was placed well proximal to the anastomosis. The abdomen was then closed with double layer 3/0 continuous catgut.

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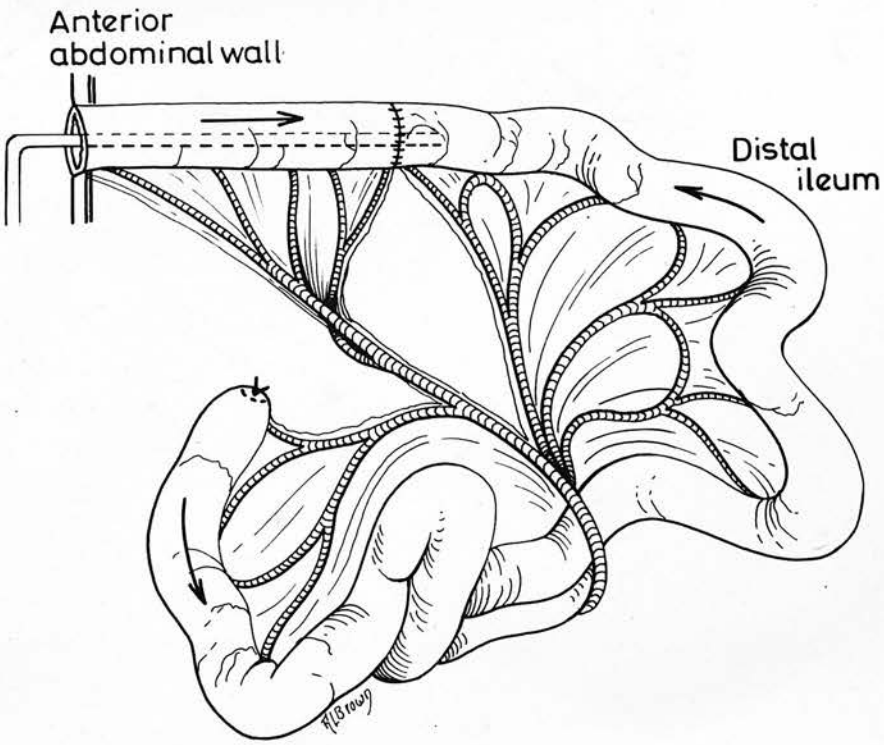


Fig. 1

Experiment 1a. The tip of the catheter is shown at the point of maximal pressure.

This operation was associated with a high morbidity, and therefore a second experimental model, similar in principle to the first but with the advantage of maintaining intestinal continuity, was adopted.

(b) In 17 rabbits segments of distal ileum were isolated and interposed between ileum and distal ileal stump. A second segment was isolated and an end-to-side anastomosis created distal to the interposed segment. Anastomoses were made with a single layer of 5/0 silk sutures. The free end of the end-to-side segment was brought out through the anterior abdominal wall in the manner of a Mann-Bollman fistula, (Figs. 2, 3 and 4). Isolated pieces of omentum were lightly looped around the anastomotic lines. At operation a Portex vinyl catheter 1.0 mm internal diameter was passed through to the proximal side of the interposed segment via the fistula, and its distal end closed.

Experiment 2

In 27 rabbits, segments of different lengths of jejunum were interposed in jejunum, with construction of a Mann-Bollman fistula distally for catheter introduction. The segments were taken from proximal jejunum, commencing 4 cm beyond the duodeno-jejunal junction and interposed iso- or anti-peristaltically. Anastomoses were made with a single layer of/

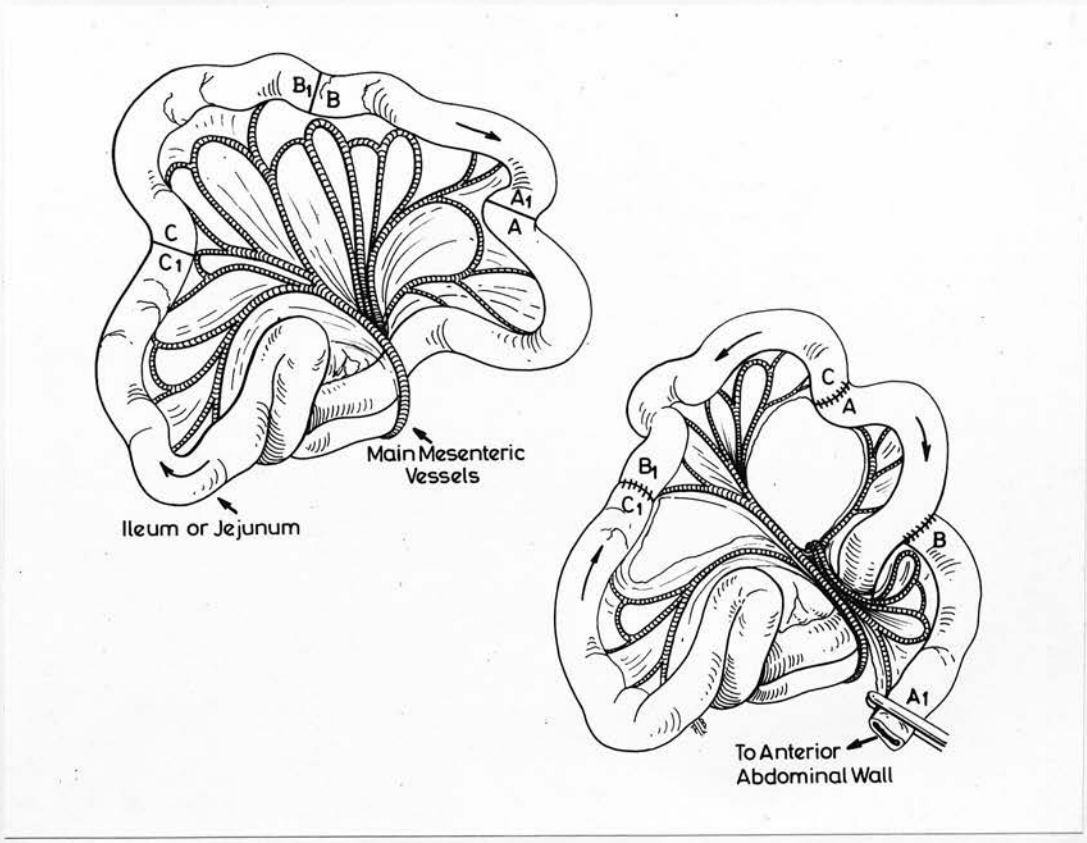


Fig. 2

Experiments 1b and 2. A diagram of the procedure adopted in these experiments showing the interposition of a reversed segment and the formation of a Mann-Bolman fistula.

Fig. 3

Photograph of experiment 1b where 10 cm distal ileum were reversed and interposed.

Fig. 4

Barium enema via Mann-Bollman fistula showing the reversed segment *in situ*.

of 5/0 silk sutures and all defects in the mesentery closed. The anastomoses were reinforced with omentum. A Portex vinyl catheter (1.0 mm internal diameter) was introduced until its tip was well proximal to the interposed segment, and the abdomen closed.

Pressure Recording Technique

Pressure changes in the bowel at the end of the catheter were recorded via a Sanborn Differential Pressure Transducer No. 267BC. For recording purposes rabbits were lightly anaesthetised with intra-venous nembutal 12 mg/kg body weight. The catheter was withdrawn in a stepwise manner until completely removed from the animal. Readings were made every 5 cm once the intra-luminal pressure at each point had reached a steady level. Individual gut contractions were automatically damped by the recording system and only mean values were recorded. All pressures were expressed in mm/Hg with zero at atmospheric pressure.

RESULTS

Range of Error

The length of each segment was determined with the segment relaxed before isolation. The range of error in measurement of varying lengths was found to be $\pm$ 0.5 cm.

The error in pressures attributable to movement of the catheter/

catheter during withdrawal was taken as that change in pressure produced by moving the tip of the catheter vertically across the depth of each rabbit and was found to be $\pm$ 0.7 mm/Hg.

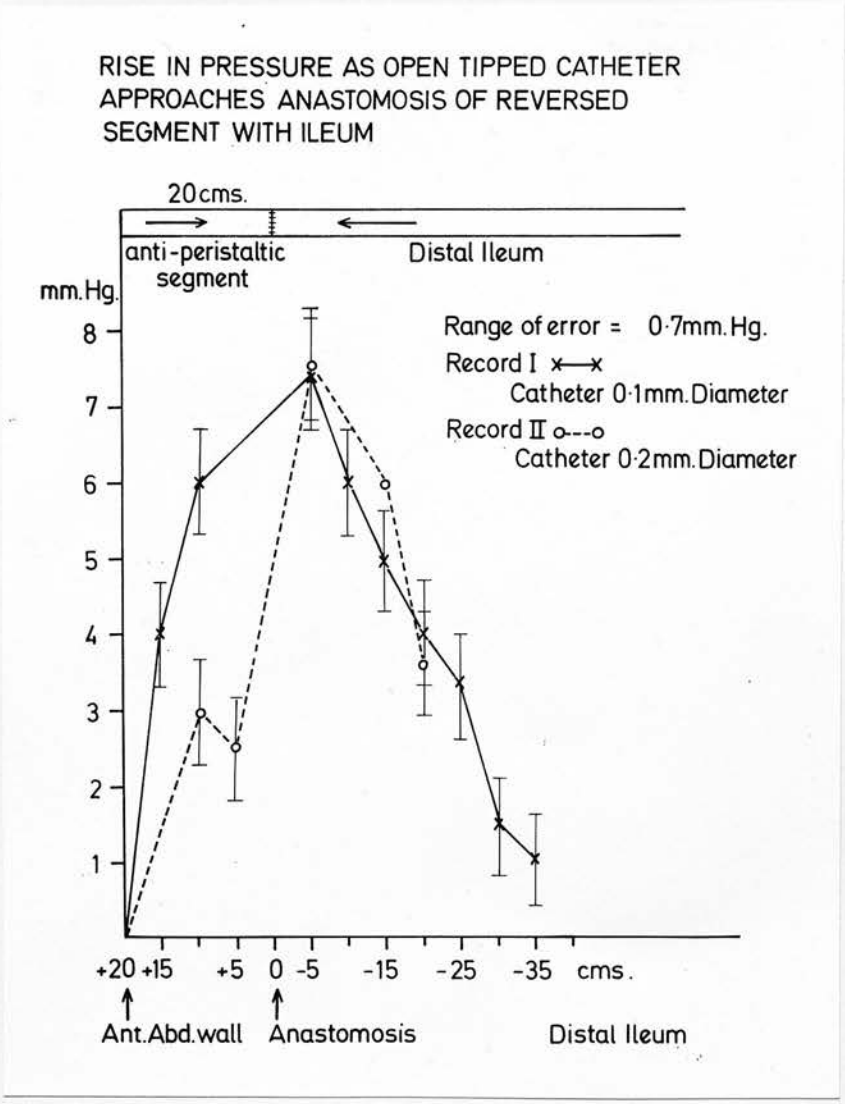
Onset of Intestinal Movement

Continuous recording from the time of closure of the peritoneum in the first 10 rabbits in each experimental group showed that jejunal and ileal contractions started within 30 minutes, and a constant pressure proximal to the interposed segment was reached within 2 hours.

Pressure Variation

Pressures proximal to interposed segments in 15 rabbits specially recorded on second or third and first or fourteenth post-operative days showed that pressures proximal to the interposed segment in each rabbit remained closely similar and within the range of experimental error.

In all but the long iso-peristaltic segments of both jejunum and ileum the highest pressures were recorded just proximal to the anastomosis. This was confirmed by radiographs showing the marked catheter tip proximal to the marked suture line. From its maximum proximal to the anastomosis, intra-luminal pressure fell rapidly as the tip of the catheter was withdrawn through the interposed segment. Graph I is a typical recording showing 2 groups/



Graph I

Pressures recorded in experiment 1a on a rabbit with a 20 cm reversed segment of distal ileum. 2 catheters of different diameters give similar results. The recordings are typical and demonstrate that there is a gradual rise in pressure as the tip of the catheter is withdrawn in a stepwise manner towards the reversed segment, and that the maximum pressure is that recorded just proximal to the anastomosis.

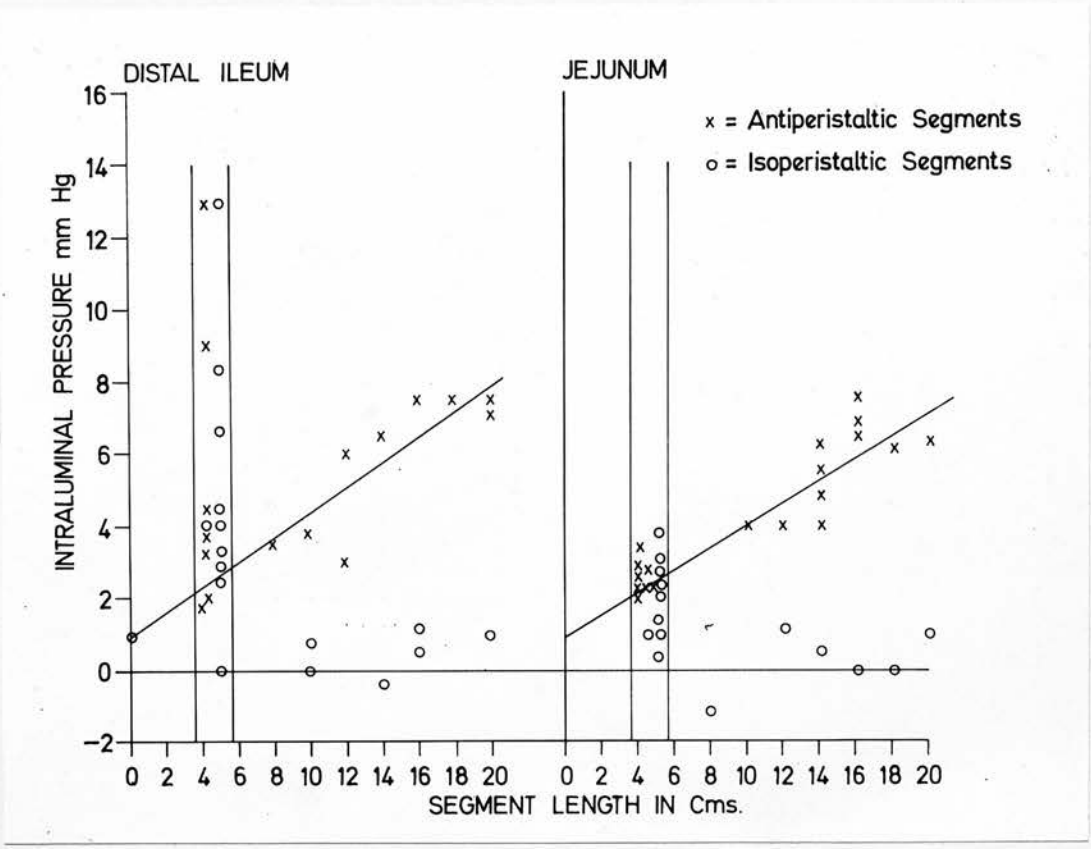
groups of results on the same animal with a reversed ileal segment 20 cm in length.

Experiment 1

(a) Of 24 rabbits in this group 6 died at operation and satisfactory recordings were made on 12. 17 of the 18 rabbits surviving the operation deteriorated rapidly within the first week and were therefore destroyed. Post-mortem examinations, carried out on all animals, showed there was anastomotic leakage in 5 of the first 10 survivors of the operation. Following reinforcement of the suture lines with an excised segment of omentum, the next 14 consecutive post-mortem examinations revealed only one leaking anastomosis. Striking features in all rabbits in this group were rapid weight loss and post-mortem findings of a near-empty caecum.

1. A linear relationship existed between proximal mean maximum pressure and segment length in all anti-peristaltic segments supplied by more than one vessel. (Graph II).
2. Mean maximum pressures to single vessel iso- and anti-peristaltic segments varied considerably despite the similarity in segment length.

(b) 2 of the 17 rabbits died at operation and satisfactory recordings were made on 15. On 6 of the rabbits, recordings/



Graph II

33 recordings on 27 rabbits with interposed distal ileal segments (experiments 1a and 1b) and 34 recordings on 27 rabbits with segments of jejunum interposed (experiment 2). Each point on the graph is pressure recorded immediately proximal to the interposed segment. The vertical lines 3.5 and 5.5 cm on the horizontal axis indicate that all pressures within this region are those of single vessel segments whose lengths were between 3.5 and 5.5 cm.

recordings were specially made on the first or fourteenth as well as second or third post-operative days.

Weight loss was not seen in this group and the post-mortem appearance of the caecum in all animals was normal.

1. The same linear relationship observed in experiment 1 (a) between proximal mean maximum pressure and segment length in anti-peristaltic segments supplied by two or more vessels was observed.
2. Interposed iso-peristaltic segments supplied by two or more vessels caused no increase in mean maximum pressure proximal to the segment.
3. Mean maximum pressures proximal to single vessel iso- and anti-peristaltic segments demonstrated the same range of values as similar segments in experiment (a).

In both experiments 1 (a) and (b) it was noticed that

1. Following isolation of a segment of distal ileum supplied by one vascular pedicle the segment immediately contracted, sometimes to half its original length and diameter. This behaviour was not seen in those segments supplied by two or more vessels (Fig. 5 and 6).
2. Recordings within single and double vessel segments indicated/

Fig. 5

Segments of distal ileum of the same resting length but supplied by one and two vascular pedicles.

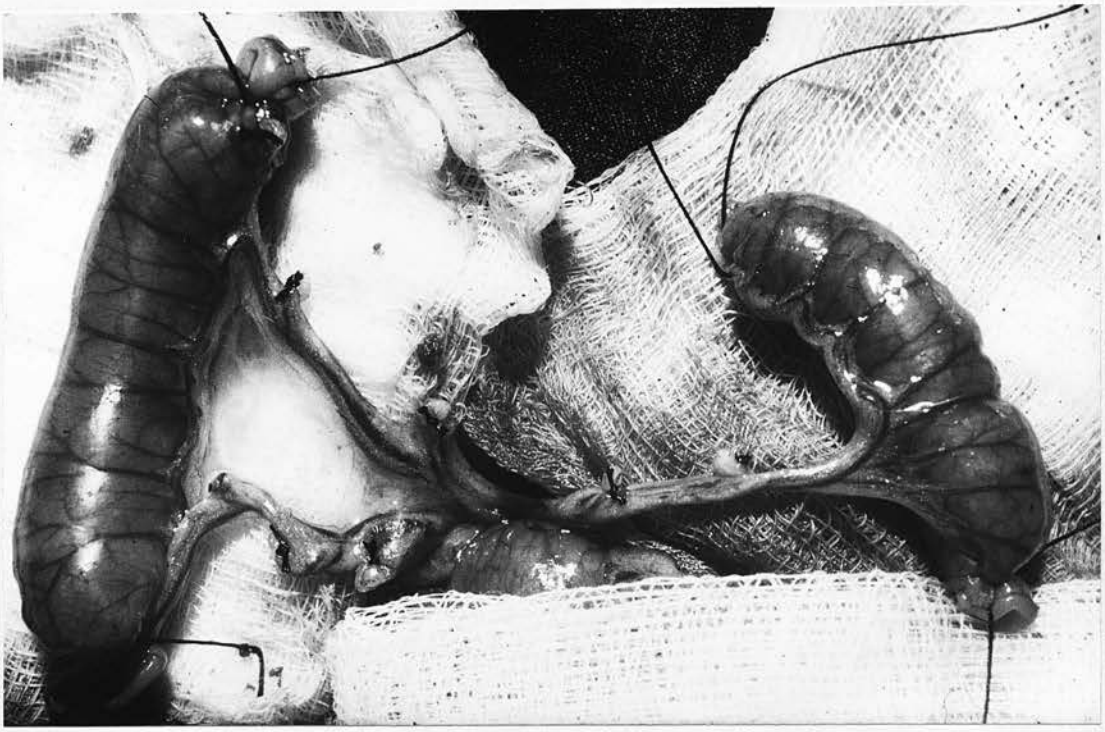


Fig. 6

Following division the segment supplied by only one vascular pedicle contracts but the other remains the same length and diameter.

indicated that peristalsis was normal in the latter but reduced or absent in the former (Fig. 7).

Experiment 2

2 rabbits died at operation. Satisfactory recordings were made on 25 animals on the second or third post-operative days. 9 rabbits were specially recorded on first or fourteenth as well as the second or third post-operative days. Weight loss was not observed in any rabbits in this group.

1. Jejunal segments supplied by two or more vessels interposed anti-peristaltically behaved in a similar manner to similar ileal segments and the mean maximum pressures recorded proximal to such segments exhibited a linear relationship to their lengths.
2. Interposed iso-peristaltic segments supplied by two or more vessels caused an increase in proximal mean maximum pressures.
3. Pressures proximal to single vessel jejunal segments of both polarities were uniformly low.
4. Isolation of single vessel segments of jejunum did not result in the marked contraction observed in the distal ileal segments.

At/

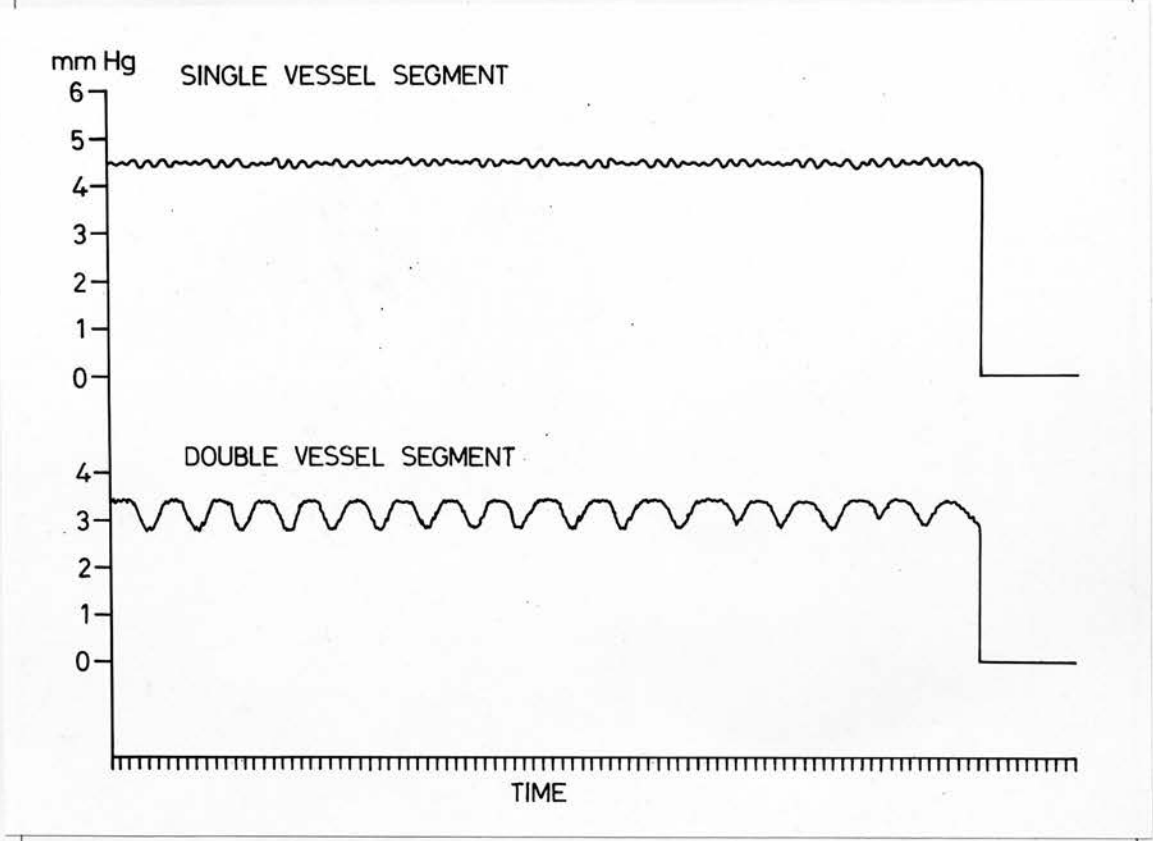


Fig. 7

Pressure recordings taken within segments supplied by one vessel (upper trace) and two vessels (lower trace). These records are typical of all one and two vessel segments and show that peristalsis is markedly reduced in the single vessel segment.

At post-mortem examination, dilatation of the intestine was found proximal to the interposed segment in all those animals in which a high mean maximal pressure proximal to the segment had been recorded in both groups. This finding indicates that these interposed segments were causing a degree of obstruction.

Relevance of Results

The results show that providing a segment of jejunum or distal ileum is supplied by more than one vessel, the degree of obstruction which is caused by anti-peristaltic interposition of such a segment is related to its length. The length of a segment is also an index of the number of vessels supplying it, and in our experiments all segments longer than 5.5 cm were supplied by more than one vessel. That pressure proximal to an interposed anti-peristaltic segment is related to the number of vessels supplying that segment is supported by the application of Spearman's Correlation test which demonstrates a direct correlation between the number of vessels supplying a segment greater than 5.5 cm in length, and the pressures proximal to these segments ($p = < 0.05$).

The linear relationship between length and pressure proximal to segments supplied by more than one vessel is shown by the best line on each graph (Graph II). The coefficient of linear correlation for distal ileal segments is 0.92 and that for jejunal segments/

segments 0.69. The two best lines are closely similar ($p = <.001$).

Comparison of all pressures proximal to single vessel jejunal and single vessel ileal segments shows there is a significant difference between them ($p = <0.002$).

Application

Interposed single vessel segments of rabbit jejunum of either polarity cause a uniformly low degree of obstruction. It is suggested that segments of this type may be used in the treatment of severe dumping symptoms with the knowledge that they will behave in a constant manner. Similar segments of distal ileum cause an unpredictable degree of obstruction and those exhibiting high tone may be suitable for sphincter substitution. Anti-peristaltic segments of both jejunum and ileum supplied by more than one vascular pedicle cause a degree of obstruction related to their length, and may have a place in the treatment of intestinal hurry by producing a graded degree of obstruction. Iso-peristaltic segments of jejunum and ileum supplied by two or more vessels do not cause obstruction and can safely be used in establishing continuity between widely separated parts of the gut, e.g. oesophago - duodenal anastomosis.

DISCUSSION

The/

The similarity in behaviour of interposed segments of jejunum and distal ileum supplied by two or more vessels contrasts sharply with the difference in behaviour between jejunal and ileal single vessel segments. Explanation of these phenomena is difficult and the work of other authors has indicated that several mechanisms may be involved:-

1. Extrinsic nervous control
2. Intrinsic nervous control
3. Hypoxia
4. Hormonal agents

In 1932 Puestow suggested that extrinsic nervous control was a factor in the response of isolated intestinal segments to feeding and that nerve fibres reaching the bowel by way of the mesentery exerted both excitatory and inhibitory functions. Others (Youmans 1949, Torbey 1960, Herrington 1966 and Poth 1969), have noticed the high tone in some isolated single vessel segments of ileum and have attempted to explain this in terms of both extrinsic and intrinsic nervous control. Youmans suggested that the motility of the intestine at a site of distension, e.g. by a food bolus, is determined by a balance between a stimulatory effect upon intrinsic mechanisms and the extrinsic reflex inhibitory effects of the distension, and showed that acetylcholine produced by intrinsic mechanisms is a factor in the maintenance of normal tonus of the intestine. He did not distinguish between the motility/

motility of different parts of the small intestine in this respect.

Torbey suggested that the interposition of a single vessel ileal segment mimics the situation which exists in Hirschprung's disease. In his animals normal intra-luminal pressures could not overcome that created by the tonically contracted interposed ileal segment, but increased intra-abdominal pressure was able to do so. He postulated that inhibitory effects are transmitted longitudinally down the intestine from one level to the next; thus, in segments supplied by two or more vessels, multiple points of entry of extrinsic nerves result in a greater central influence on smooth muscle permitting inhibition, whereas in single vessel segments more complete decentralisation is obtained, and the increased tonicity of such a segment may be explained on the basis of denervated adjacent neurons. The more extensively innervated arcade type vascular pedicle provides sufficient extrinsic innervation of the segment to maintain a normally reactive intrinsic nervous system capable of synchronous contraction and adjacent relaxation of smooth muscle elements.

J. Kerwenter (1965) in some elegant experiments on cats, demonstrated that though the jejunum and ileum are supplied by vagal nerve fibres to approximately the same extent, vagal stimulation induced motor responses in the jejunum every time, but motor responses in the ileum were absent in about half of the experiments. This difference was thought to be due to the action/

action of inhibitory fibres in the splanchnic nerves which are distributed mainly to the ileum: such an inhibitory neurogenic action could completely suppress the vagal excitatory response in the ileum.

Using isolated muscle strips from the human gastro-intestinal tract Bennett and Whitney (1966) demonstrated that intrinsic parasympathetic (excitatory) activity was marked in the jejunum and that it effectively masked low jejunal intrinsic sympathetic (inhibitory) activity. In the distal ileum the intrinsic sympathetic supply predominated over the parasympathetic.

Davenport (1966) states that smooth muscle and intrinsic nerve plexuses of the small intestine are alone sufficient to perform segmentation and peristalsis, but extrinsic innervation affects the occurence and modifies the strength of those movements and mediates reflexes by which stimuli acting in one part of the intestine govern activity in the rest of the bowel.

H.W. Kosterlitz (1964) has shown that anoxia increases excitability in the jejunum before causing total paralysis. Gastrin and other gastro-intestinal hormones have been shown to influence motility in different ways in different parts of the alimentary tract (Grossman 1966).

In my experiments it is possible that a degree of hypoxia was produced by surgical manipulation, though this was not assessed directly. If so, hypoxia may have contributed to the results although/

although the fact that similar responses were obtained on a number of occasions over a fourteen day period in specially recorded segments suggests that hypoxia was not an important factor. The part played by gastro-intestinal hormones in inducing differential responses was not assessed in these experiments.

The results support the suggestions of other authors that the complex relationship between tone and motility in the small intestine involves both stimulatory and inhibitory functions of the intrinsic and extrinsic nerve groups. The independent activity of the muscle cells themselves may also be involved.

Because normal peristalsis and segmentation is exhibited by isolated segments of jejunum and ileum supplied by more than one vessel whether interposed in an anti- or iso-peristaltic manner, the normal controlling mechanisms must have remained intact. The linear relationship between pressures seen proximal to the longer reversed segments and segment length, indicates that peristalsis in the reversed segment is mainly responsible for the higher pressures recorded.

The jejunal single vessel segments behaved in the same manner as longer multi-vessel segments. Pressures recorded proximal to them thus fall on the best line seen in Graph II. However, the unpredictable behaviour of single vessel ileal segments suggests that the normal mechanisms influencing tone

and/

and motility are modified in some way by isolation. In all the distal ileal single vessel segments, motility in terms of segmental contractions was decreased, and tone was the variable factor.

If tone is dependent on the excitatory (parasympathetic) system as suggested by Youmans, the increase in tone in some distal ileal segments might be explained on the basis of interruption of the extrinsic inhibitory (sympathetic) fibres. Kerwenter suggests that extrinsic inhibitory fibres are not distributed to the jejunum, and are distributed to the ileum in a variable manner. Thus, if extrinsic mechanisms <u>are</u> responsible for tone in a jejunal segment, the isolation of such a single vessel segment would have no effect on tone. My findings of normal tone in jejunal single vessel segments and variable tone in single vessel ileal segments are in keeping with those suggestions.

Undamped intra-segmental pressure recordings indicate that mechanisms additional to those controlling tone, are involved in motility. Interruption of inhibitory tracts to the distal ileum where there is a higher degree of intrinsic sympathetic control than in the jejunum and a variable extrinsic sympathetic distribution, causes a variable change in tone and a constant diminution in motility.

FURTHER INVESTIGATIONS ON THE FACTORS RESPONSIBLE FOR TONE IN ISOLATED GUT SEGMENTS

Contracted/

Contracted segments of gut exhibiting high tone resist dilatation and increase in volume more than flaccid low tone segments. A series of further experiments are planned based on the segmental resistance to filling as an index of tone and it is hoped that the mechanisms responsible for tone will be more clearly defined.

Experimental Design

Experiments will be conducted in rabbits in which segments supplied by one vessel will be matched for length with segments supplied by two or more vessels. Isotonic saline at body temperature will be pumped slowly into the segments and the resistance to filling recorded (Fig. 8).

The adrenal glands will be isolated before the start of each experiment in order to avoid the effect of extrinsic catecholamines on the gut segments.

It is planned to compare the tone of similar jejunal and ileal segments as exemplified by their resistance to filling in the following experimental groups:

(a) Segments supplied by one or more vessels matched for length.

(b) Segments devoid of sympathetic and parasympathetic extrinsic control will be prepared by stripping the mesentery from vessels supplying the segments.

(c) Section of the vagi in the neck or abdomen: the effect of/

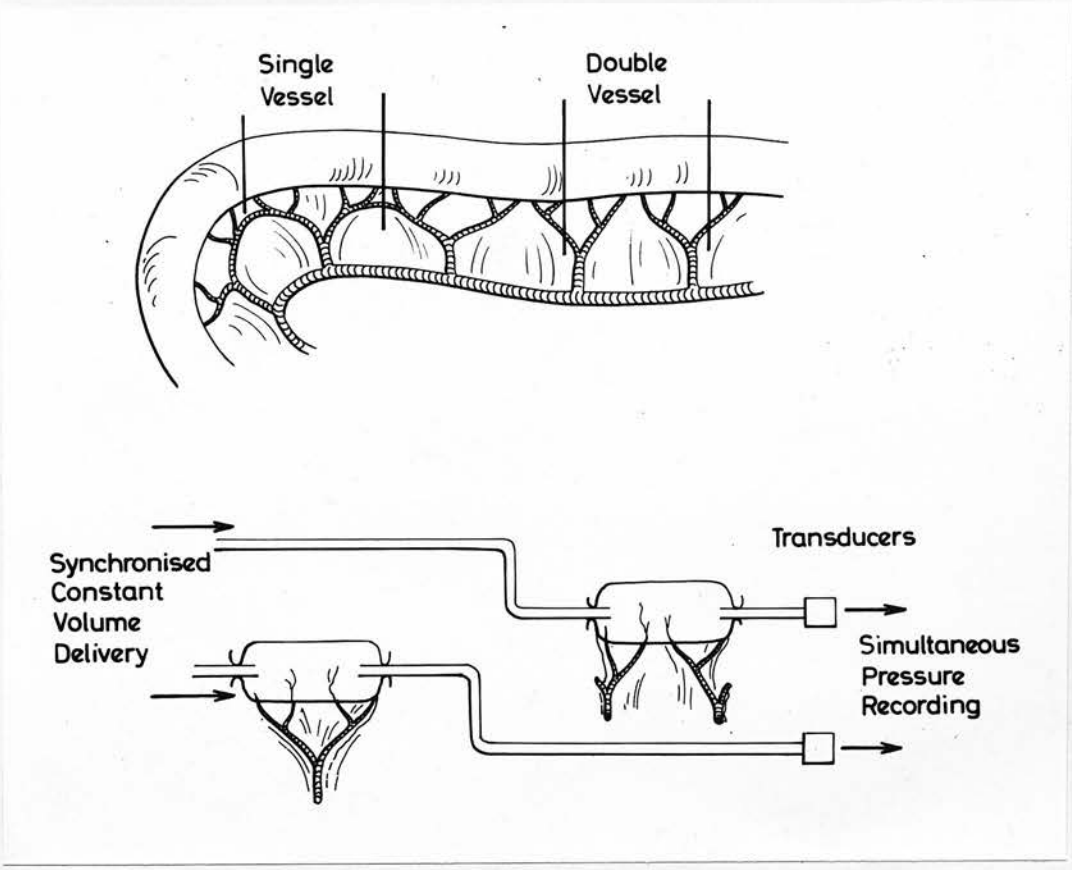


Fig. 8

Experimental model for further work on the relationship between tone, vascular supply, and nervous control of isolated gut segments. In this diagram a segment supplied by one vascular pedicle is compared with a segment of the same initial length supplied by two vessels.

of the extrinsic sympathetic supply will be assessed by comparing the results of this experiment with those of experiment (b).

(d) Section of the splanchnic nerves at a subdiaphragmatic level. The effect of the extrinsic parasympathetic supply will be assessed by comparing the results of this experiment with those of experiment (b).

(e) PO_2 electrodes will be used to determine the effect of segment isolation, (on the basis of vascular supply,) on the PO_2 of the segment in order to show whether the increased tone observed in some segments is due to fall in PO_2.

Results

The model has been established, and early results from the first experiment comparing the resistance to filling in similar length segments of distal ileum supplied by one, two or three vessels show:

1. The contraction of the single vessel segment similar to that shown in Figs. 5 and 6, is seen (Fig. 9,10.)
2. Resistance to filling is greater in most single vessel segments than in segments of similar length supplied by more than one vessel (Fig. 11.). In a series of 19 paired experiments there were two exceptions to this rule/

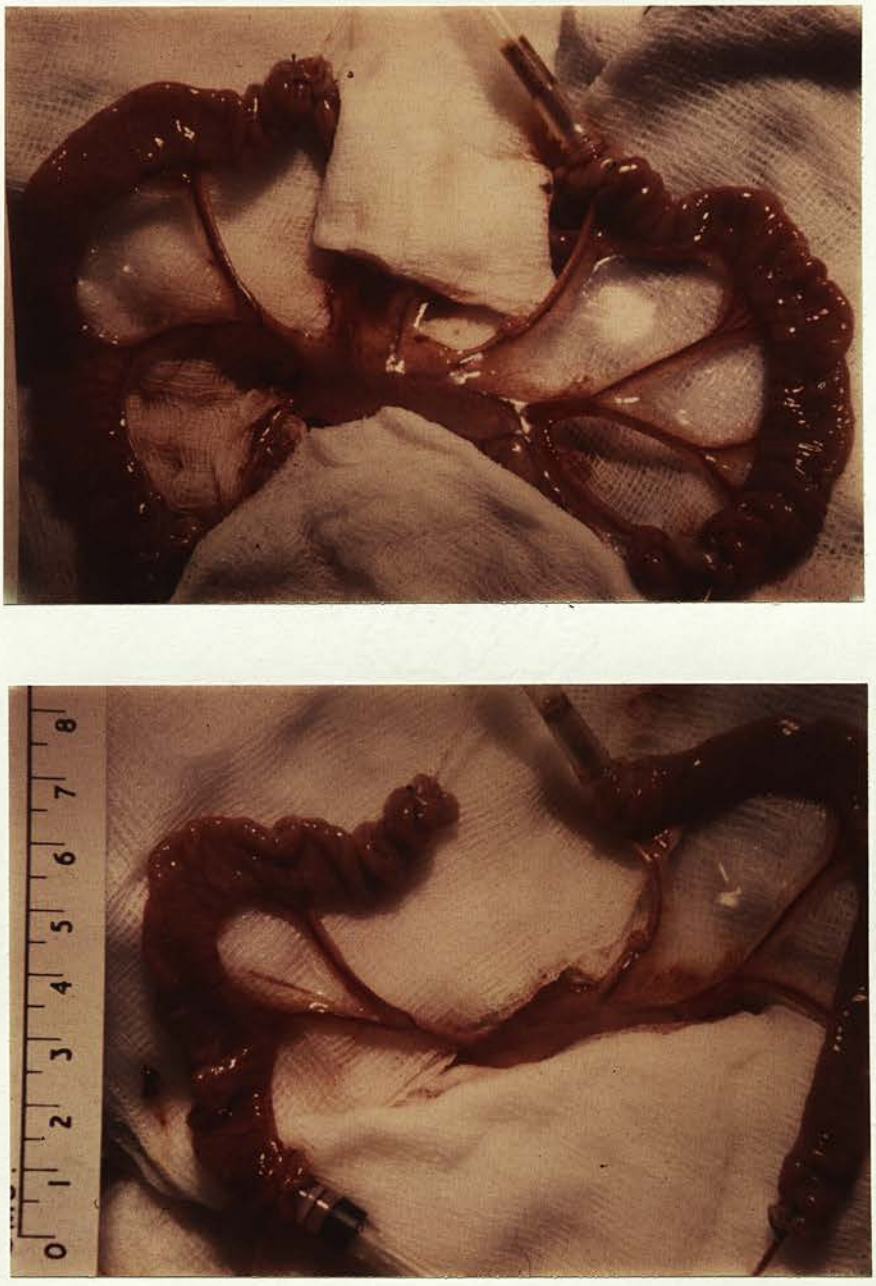


Fig. 9

Photograph of gut segments isolated as in Fig. 8. The cannulas for filling and pressure recordings are shown. The segments were initially the same length (upper) but after isolation the single vessel segment contracted (lower).

Fig. 10

Photograph showing marked contraction of a single vessel segment following isolation, compared with a segment of the same pre-isolation length.

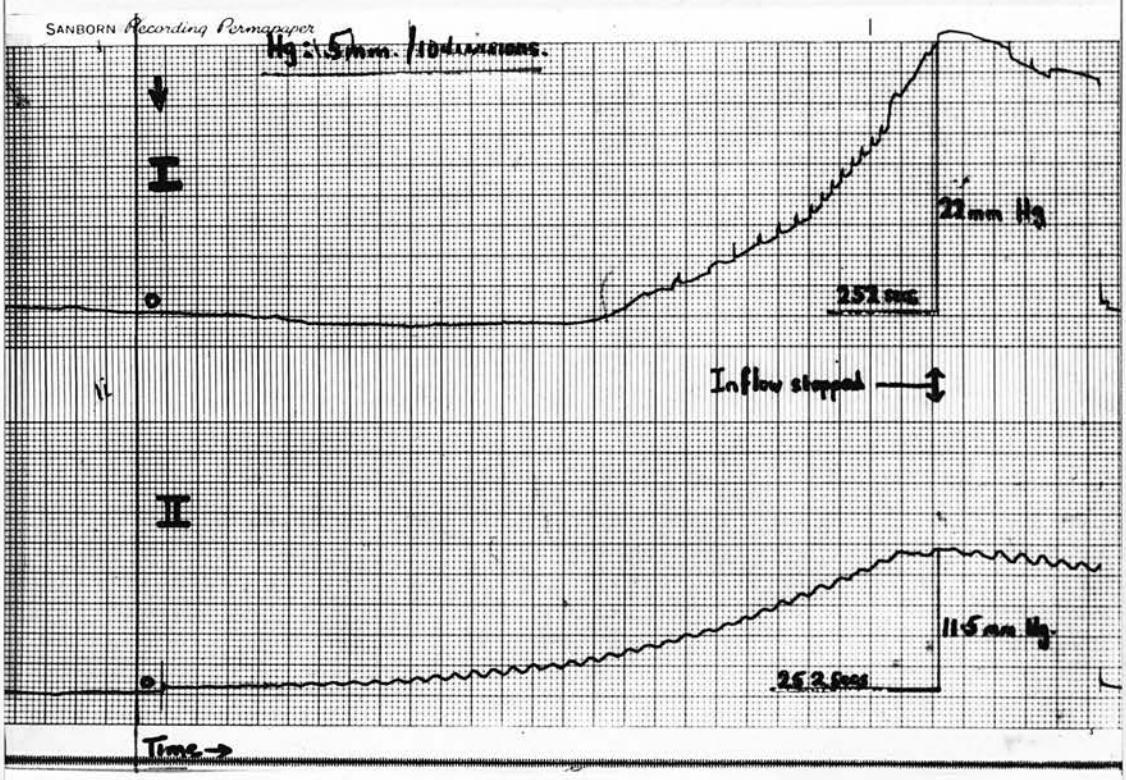


Fig. 11

Photograph of 2 synchronous recordings: the upper recording shows the rise in pressure in a segment supplied by one vessel. The lower segment records pressure in a segment which was the same length as the first segment, but supplied by 2 vessels. The more rapid rise in pressure in the former segment indicates that there was a greater resistance to the same filling pressure and volume than in the latter segment, i.e. the tone is higher in the single vessel segment.

TABLE 1

Temperature and time constant for each pair of readings		
Segment length (cms)	Number of vessels supplying segment	pressure reached in standard time for each pair (mm/Hg)
5	1	20
5	2	10
5	1	17
5	2	9.5
5	1	22
5	2	11
10	1	46
10	2	27
6	1	24
6	2	10
6	1	42
6	2	25
10	1	22
10	2	28 *
6	1	40
6	2	30
6	1	24
6	2	5
6	1	44
6	2	12
8	1	43
8	2	6
6	1	36 *
6	2	45
6	1	44
6	2	34
6	1	46
6	2	32
10	1	41
10	3	15
10	1	48
10	3	11.5
25	1	37
25	3	21
12	1	50
12	3	19
8	1	42
8	3	8.5

Final filling pressures in segments with one vessel compared with two or three vessel segments.
*** Exceptions to the rule that pressure is highest in single vessel segment.**

Table I

Final filling pressures in segments with one vessel compared with two or three vessel segments. In each pair of experiments the time, filling pressure, volume delivered and temperature were the same. With the exception of the two pairs of results marked (*) the tone is higher in single vessel than multi-vessel segments of the same length.

rule (Table I).

These early results reinforce the suggestion that in some single vessel distal ileal segments tone is higher than in segments of the same length supplied by more than one vessel. When the other experiments outlined above have been conducted, it may be possible to state the factors responsible for tone and to show why there is a difference in behaviour between some segments of jejunum and distal ileum, and why some distal ileal segments behave so unpredictably.

SUMMARY

Segments of jejunum and distal ileum of varying lengths and different vascular supply were isolated and interposed iso- and anti-peristaltically. Pressures proximal to the interposed segment were recorded with a fine soft open-tipped catheter introduced via a Mann-Bollman fistula.

1. The distal ileal segments supplied by a single vessel exhibit an unpredictable high degree of tone in some cases, and when these segments were interposed they caused a high degree of partial obstruction irrespective of whether they were interposed iso- or anti-peristaltically. Distal ileal segments supplied by two or more vessels interposed anti-peristaltically caused/

caused a degree of obstruction related to their lengths, and interposed iso-peristaltically they caused no obstruction.

2. Jejunal single vessel segments of both polarities exhibited low obstructive qualities. Anti-peristaltic jejunal segments of two or more vessels supply behaved in a similar manner to corresponding ileal segments in that the degree of obstruction was related to the length of the segment. Iso-peristaltic segments supplied by two or more vessels caused no obstruction.
3. Possible mechanisms accounting for the differing findings in jejunum and ileum are discussed.
4. Some clinical applications are discussed.
5. Further experiments on the factors controlling tone in rabbit ileal and jejunal segments are outlined and the initial results are discussed.

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